

NEW ORGANISMS OF CHROMOMYCOSIS¹

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The organisms of the disease chromomycosis (chromoblastomycosis of Terra, Torres, da Fonseca & Arêa de Leão), or dermatitis verrucosa, have received little comparative study. Except for the recent investigations of Carrión and Emmons, no attempts have been made to point out definite morphological relationships among these microbes. The only well-established fungus of the group is *Phialophora verrucosa* Thaxter, which has been isolated only twice in the United States and once in Uruguay. Another organism treated in several publications, *Acrotheca Pedrosoi*, is the only agent of chromomycosis of South America, according to a number of mycologists. A Brazilian pathogen from this disease, studied by French workers, was first named *Hormodendron Pedrosoi* Brumpt, and later the name was changed to *Trichosporium Pedrosianum* by Ota, and then to *T. Pedrosoi* by Langeron. This microbe, considered to be identical with other Brazilian fungi causing chromomycosis, has led to some taxonomic confusion.

While in São Paulo, Brasil, the opportunity was presented to make a comparative study of a number of cultures of fungi isolated from cases of chromomycosis in South America and in North America, in the laboratory of the junior author. As a result of an intensive examination of these pathogens, the fol-

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lowing conclusions were arrived at: First, *Phialophora*, as described by Thaxter, not only exists in South America, as was pointed out by MacKinnon in Uruguay, but an original strain studied by Pedroso and Gomes (named *P. verrucosa* by these workers and then changed to *Acrotheca Pedrosoi* by other South American investigators) was found to be a new species, *Phialophora macrospora*. Second, *Hormodendron Pedrosoi* Brumpt (*Trichosporium Pedrosoi* Langeron) shows sufficient characters other than those of the genus *Hormodendron* to form a new genus, *Hormodendroides*, with *H. Pedrosoi* as the type species. Third, *Gomphinaria Pedrosoi* (Brumpt) Dodge (*Acrotheca Pedrosoi* of Terra, Torres, da Fonseca & Leão), an organism which was considered identical with *Hormodendron Pedrosoi*, was found to have characteristics simulating those of the genus *Botrytis* and also certain features not belonging to that genus. For these reasons the genus *Botrytooides* is described as new, but since *Pedrosoi* is the specific name for the type species of *Hormodendroides* the name *monophora* is given to the type species of the new genus. Fourth, an organism isolated in Brasil from a case of chromomycosis has the characteristics of all the above genera: the "cup" formation common to *Phialophora*, the conidiophores common to *Botrytooides*, *Hormodendroides*, and *Hormodendron*, in addition to the superimposition of the "cup" formation on the *Hormodendron* conidiophores. This fungus is here described as a new genus, *Phialoconidiophora*. It is given the specific name of *P. Guggenheimia* in honor of the Foundation which made the work possible. The organism *Hormodendron compactum* Carrión is no doubt of this same genus, but differs sufficiently in cultural features and mycelial measurements to be a new species, *Phialoconidiophora compactum* (Carrión) Moore & Almeida, n. comb.

Although not entirely in favor of establishing a number of new genera for a group of organisms which show close relationships in certain aspects, yet the authors feel that the so-called "lumping" or grouping of several distinctly different microbes in the same genus adds only to the existing confusion in the taxonomy. Hence the following new genera are de-

scribed provisionally until a mycological classification is established which will allow for a taxonomic differentiation of such organisms.

The fungi are here described with English and Latin diagnoses. A more complete and illustrated discussion will follow in a later publication.

Phialophora macrospora Moore & Almeida, sp. nov.

Phialophora verrucosa A. Pedroso & J. M. Gomes, Bull. Soc. Med. Cir. São Paulo 3: 254. 1920; Gomes, *ibid.* 3: 42, 43. 1920; Ann. Paulistas Med. Cir. 11: 53-61. 1920.
Acrotheca Pedrosoi Terra, Torres, da Fonseca & Arêa de Leão, Brasil Medico 2: 363-368. 1922.

This species differs from *P. verrucosa* in the size of the spores and "cups." Spores large, spherical, ovoid or ellipsoid, elongate or short, variable in form and size; spherical up to 7 μ in diameter, ellipsoid 2-4 \times 3-7 μ . Hyphae branched, septate, 2-6 μ in diameter. Spore-bearing cups 2-7 μ in diameter at lips, chiefly 4-5 μ . Oidioid cells approximately 5 μ in diameter. Spherical cells on Loeffler's agar 6-14 μ in diameter, usually 12 μ . Color of colonies grayish-brown, olivaceous-green to black.

Differt ab *P. verrucosa* in magnitudine sporarum phialarumque. Sporae magnae, multiformes, sphaericae, ovoideae vel ellipsoideae, elongatae vel breves; sphaericae ad 7 μ diametro; ellipsoideae 2-4 \times 3-7 μ . Hyphae ramosae, septatae, 2-6 μ diametro. Phialae 2-7 μ diametro ad labias, plerumque 4-5 μ . Oidia circiter 5 μ diametro. Cellulae sphaericae in "Loeffler's agar" 6-14 μ diametro, plerumque 12 μ . Color "grayish-brown," "olivaceous green" vel nigrum.

Botrytoides Moore & Almeida, gen. nov.

Simulates *Botrytis* morphologically but differs in the blue-black color of culture. Hyphae repent, branched, septate, submerged on most substrates. Conidiophores simple or branched or proliferating, brown with simple, irregular tips due to presence of small continuations of conidia (sterigmata of some authors) which remain after conidia mature and separate from conidiophore. Conidia fusiform to short-cylindric,

several attached close together at the tip of the conidiophore, brown or subhyaline in color.

Hoc genus *Botrytidi* similis, differt in culturis atris. Hyphae repentes, ramosae, septatae, plerumque submersae. Conidiophorae simplices vel ramosae proliferantesve, fulvae, simplicibus irregularibusque cum apicibus, sterigmatibus minutis persistentibus tectis. Conidia fusiformia aut brevia, cylindrica, catervatim plerumque apicalia, fulva vel subhyalina.

The genus *Campsotrichum*, generally considered to be a dematiaceous *Botrytis*, is to be differentiated from *Botrytoides* on the basis of conidiophore morphology and spore distribution. The conidiophores of *Campsotrichum* terminate in short, bifurcated branches with the spores arranged on short branchlets, as contrasted with the simple or branched conidiophores of *Botrytoides*.

The type species of this genus is:

***Botrytoides monophora* Moore & Almeida, sp. nov.**

Phialophora verrucosa A. Pedroso & J. M. Gomes, Bull. Soc. Med. Cir. São Paulo 3: 254. 1920; Gomes, *ibid.* 3-42, 43. 1920; Ann. Paulistas Med. Cir. 11: 53-61. 1920.

Hormodendron Pedrosoi Brumpt, Précis Parasitol. ed. 3. 1921.

Acrotheca Pedrosoi Terra, Torres, da Fonseca & Arêa de Leão, Brasil Medico 2: 363-368. 1922.

Trichosporium Pedrosianum Ota, Jap. Jour. Derm. Urol. 28⁴: 6. 1928. (In Emmons, 381-423, Abs. in Fr. 16-23.)

Trichosporium Pedrosoi Langeron, Ann. Parasitol. Hum. Comp. 7: 145-150. 1929.

Gomphinaria Pedrosoi Dodge, Med. Myc. p. 850. 1935.

Colonies dark, greenish-gray, olivaceous-green to black with a brown or purple tinge. Conidiophores single or multicelled, lateral or terminal. Spores ovoid, ellipsoid, or subfusiform, $1\frac{1}{2}$ -5 \times 2-8 μ , arranged along the conidiophore or in head formation. Hyphae of regular, irregular, or sclerotic cells, 2-5 μ in diameter, depending on medium grown.

Culturae obscurae, viridi-cinereae, "olivaceous-green" vel nigrae, fulvescentes purpurascetesve. Conidiophorae uni- aut multi-cellulae, laterales aut terminales. Sporae ovoideae, ellipsoideae aut subfusiformes, $1\frac{1}{2}$ –5 \times 2–8 μ diametro, in conidiophoris aut in capitibus dispositae. Cellulae hypharum regulares aut irregulares aut scleroticae, 2–5 μ in mediis diversis.

Hormodendroides Moore & Almeida, gen. nov.

Mycelium black, septate, branched. Conidiophores of two types: simple with conidia fusiform to short-cylindric, several attached on irregular, thickened, terminal portion of conidiophore; and conidiophores of *Hormodendron* type with spores catenulate in acrogenous branches, subspherical or ellipsoid.

Mycelium nigrum, septatum, ramosum. Conidiophorae bifformes: (1) simplices, conidiis pyriformibus vel breve-cylindricis, aliquot in irregulare crassata terminale parte conidiophorae junctis; (2) ramosae *Hormodendro* similes, sporis catenulatis, acrogenis, subsphericis aut ellipsoideis.

The type species is *Hormodendron Pedrosoi* Brumpt.

Hormodendroides Pedrosoi (Brumpt) Moore & Almeida, comb. nov.

Hormodendron Pedrosoi Brumpt, Précis Parasitol. ed. 3. 1921.

Acrotheca Pedrosoi Terra, Torres, da Fonseca & Arêa de Leão, Brasil Medico 2: 363–368. 1922.

Trichosporium Pedrosianum Ota, Jap. Jour. Derm. Urol. 28⁴: 6. 1928.

Trichosporium Pedrosoi Langeron, Ann. Parasitol. Hum. Comp. 7: 145–150. 1929.

Gomphinaria Pedrosoi Dodge, Med. Myc. p. 850. 1935.

Phialoconidiophora Moore & Almeida, gen. nov.

This genus differs from *Phialophora* by the presence on various media of the three types of conidiophores: dendroid, branching conidiophores of the *Hormodendron* type, with "cupulliform" spore-bearers generally produced at the apices of the "conidiophores," but sometimes laterally; and conidiophores of the *Botrytoides* type; and also by the "cupulli-

form" spore bearers of the *Phialophora* type. Cells (chlamydospores) of the type seen in tissue. Spores from "cups" globoid to ovoid, small, hyaline to subhyaline and held together by a mucilaginous substance; spores from conidiophores of *Botrytoides* type ovoid, ellipsoid, or subfusiform, larger than the above; spores of *Hormodendron* type catenulate in acrogenous branches, subspherical or ovoid. Hyphae branched and septate.

In mediis diversis hoc genus differt ab *Phialophora* in conidiophoris dendroideis ramosis, *Hormodendro* similibus, et phialis plerumque apicalibus vel aliquot lateralibus; et conidiophoris *Botrytoidi* similibus; et sporophoris phialidis *Phialophorae* similibus. Cellulae (chlamydosporae) eis in hospite similes. Sporae ab phialis globoideae vel ovoideae, parvae, hyalinae vel subhyalinae, materia mucilaginosa cohaesae; sporae conidiophoris *Botrytoidi* similibus ovoideae, ellipsoideae vel subfusiformes, maiores quam eae in *Botrytoidi*; sporae *Hormodendro* similes catenulatae in ramis acrogenis, subsphaericae vel ovoideae. Hyphae ramosae et septatae.

The type species of the genus is:

***Phialoconidiophora Guggenheimia* Moore & Almeida, sp. nov.**

Mycelium aerial or submerged. Cultures olivaceous-green, grayish-black tinged with purple or black. Hyphae 2–4½ μ in diameter, bearing conidia 1½–4½ \times 3–8 μ , sessile, single and isolated, or on short to long, single or multicelled, warty conidiophores, simple, branched, or proliferating, of *Botrytoides* type. Conidiophores of *Hormodendron* type with smooth to warty "foot cells" of various proportions, bearing several phialides approximately 2–4 \times 4–10 μ , with conidia 1½–4½ \times 3–8 μ , Phialae 2–6 μ in diameter at lips, borne either on specialized branches or developing directly from hyphae or on stalks, one to several-celled; spores mostly hyaline, globoid 1–3 μ in diameter, ovoid 1–2½ \times 2–4 μ . Oidioid cells 4–7 μ in diameter or long axis. Bundles of hyphae (coremioid) with hyphae 2–3½ μ in diameter. Sclerotic cells of various proportions. Chlamydospores thick-walled, single or multilocular, approximately 3–16 \times 3–16 μ , some larger on various media.

Mycelium aerium aut submersum. Culturae "olivaceous green," "grayish black" purpurascens vel nigrescens. Hyphae 2–4½ μ diametro. Conidia 1½–4½ \times 3–8 μ , sessilia, singula aut in conidiophoris multicellulis verrucosis simplicibus ramosis aut proliferantibus *Botrytoidi* similibus. Conidiophorae *Hormodendro* similes cellulis basalibus laevibus vel verrucosis, diversae magnitudine, phialides circiter 2–4 \times 4–10 μ ferentae, cum conidiis 1½–4½ \times 3–8 μ . Phialae 2–6 μ diametro ad labias, sessiles, in conidiophoris aut in stipibus, uni aut pluri-cellulae. Sporae subhyalinae vel plerumque hyalinae, globoideae, 1–3 μ diametro, ovoideae 1–2½ \times 2–4 μ . Oidia 4–7 μ diametro in axe longo. Hyphae in fasciculis 2–3½ μ diametro. Cellulae scleroticae diversae magnitudine. Chlamydo-sporae cum muris crassis, singulae, multiloculatae, 3–16 \times 3–16 μ , aliquando maiora in mediis diversis.

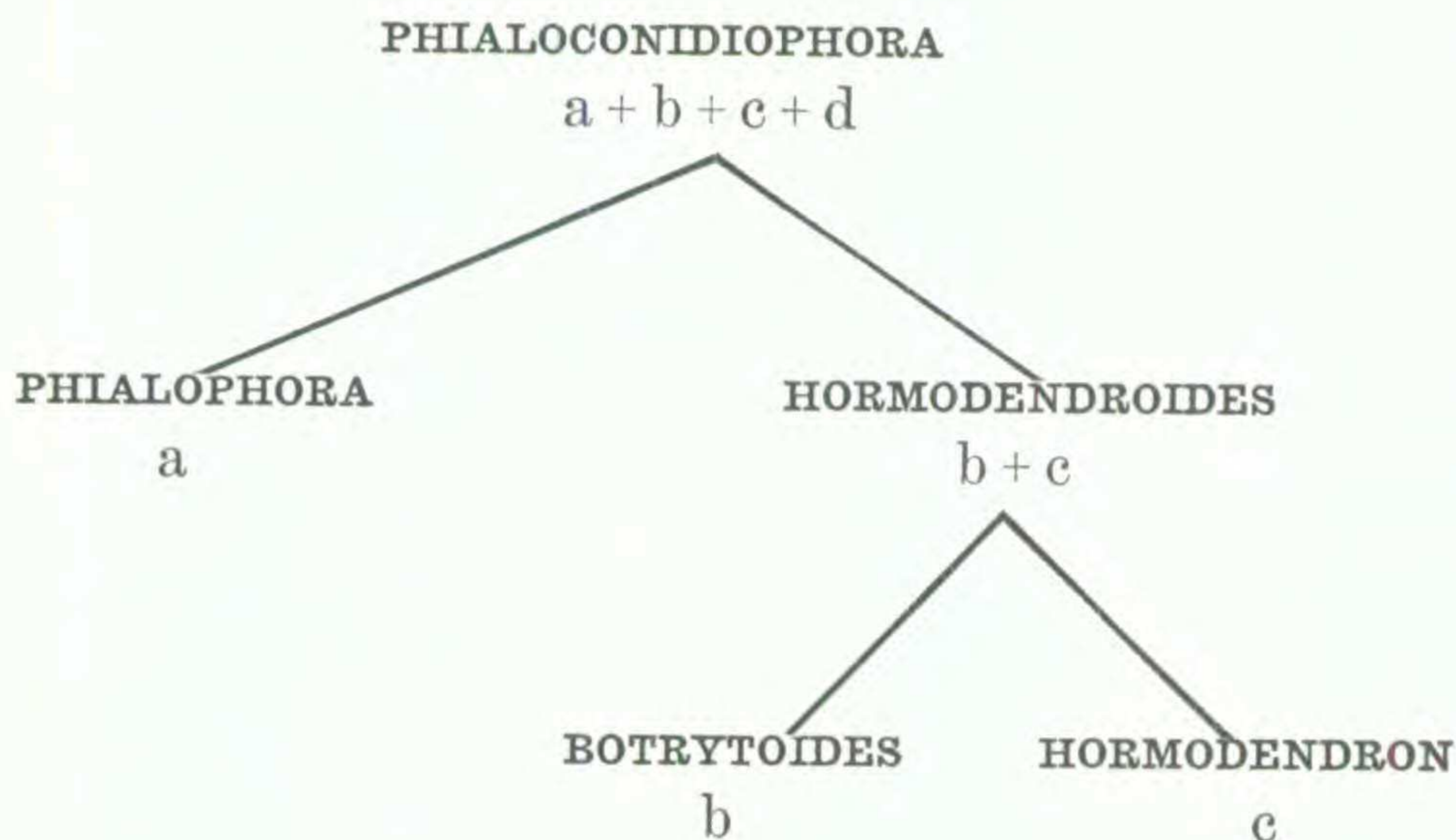
Phialoconidiophora compactum (Carrión) Moore & Almeida, comb. nov.

Hormodendrum compactum Carrión. A. L. Carrión, Puerto Rico Jour. Publ. Health 10: 543–545. 1935; *ibid* 11: 663–681 (679–681). 1936.

Hyphae long, coarse, 2.5–5.2 μ , arborescent, with occasional dichotomous branching. *Hormodendron* sporulation predominant; *Phialophora* type rare. Conidia in former spherical or subspherical, smooth, olivaceous, borne in short branching chains, in compact groups at tip of conidiophores, 2.5–4.8 \times 2.5–3.8 μ . Basal elements in chains 3.8–6 \times 3–4.5 μ . Conidiophore of *Phialophora* type 7–12 \times 3–4 μ . Conidia 1.5–2 \times 2–3 μ , oval, smooth, thin-walled and light green in color. Growth on Sabouraud's agar slow, colonies 2.5 cm. in diameter after 6 weeks. Abundance of aerial hyphae, amber in color. Colonies on 4 per cent dextrose agar similar except for a smoother, more velvety appearance. Colony on Czapek's agar poorly developed, with a diameter of 10–16 mm. at end of 6 weeks. Mycelium in substrate olive-black.

The generic relationship in question here can be brought out more clearly if the phylogeny is considered speculatively. Assuming that the organism with the most complicated life cycle

is the oldest, and the simplest the youngest, then we can trace a direct descendance of one group from another. If we let "a" represent the "cup" formation of *Phialophora*; "b" the conidiophores of *Botrytoïdes*; "c" the conidiophore of *Hormodendron*; and, "d" the compound formation of the "cup" formation of *Phialophora* superimposed, as it were, on the conidiophore of *Hormodendron*, then the schematic arrangement is greatly simplified as follows:

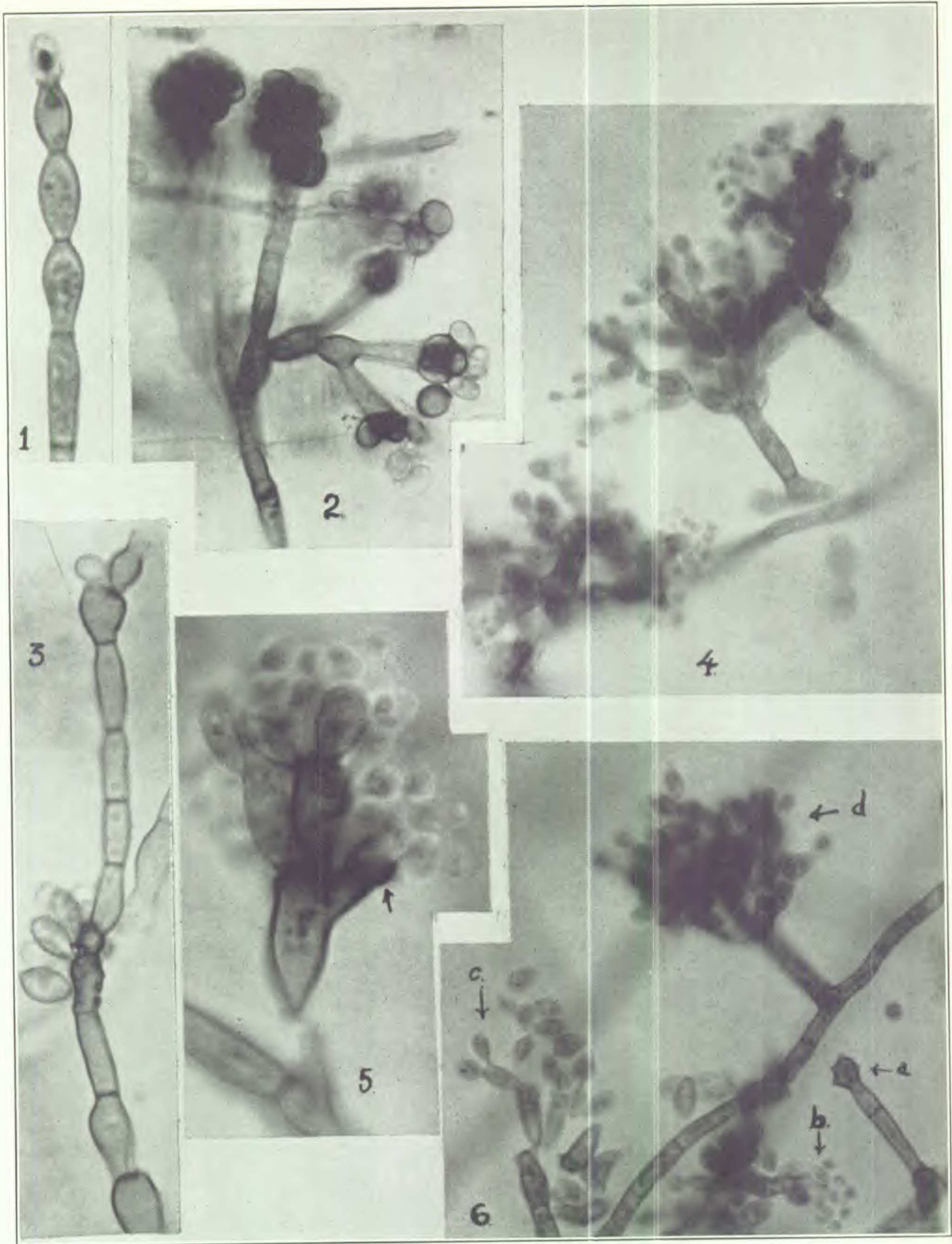


NOTE. Since this paper went to press the authors have found that Bonorden spelled the genus name *Hormodendrum* and not *Hormodendron* as they and most medical mycologists have given it. The spelling should be changed throughout this paper.

EXPLANATION OF PLATE

PLATE 26

- Fig. 1. "Conidiophore" of *Phialophora macrospora* with emerging spore.
Fig. 2. "Conidiophores" of *P. macrospora* with groups of spores.
Fig. 3. Conidiophores of *Botrytoides monophora*.
Fig. 4. "Conidiophores" of *Phialoconidiophora Guggenheimia*, of *Hormodendron* type with cups of *Phialophora* type.
Fig. 5. Enlarged "conidiophore" showing "cupulliform" spore bearer.
Fig. 6. Mycelium of *P. Guggenheimia* showing: a. conidiophores of *Botrytoides* type. b. "cupulliform" spore bearer. c. *Hormodendron* type of spore formation. d. conidiophore of c.



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